



*Photo 1: Horizontal shaft machine.*

## Mulching Machines for Pre-commercial Thinning and Fuel Reduction

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**W**ildfires in the western United States and Florida over the last several years have highlighted the vulnerability of dense overstocked stands to fire. As a result, landowners, land managers, and researchers alike are interested in methods to reduce hazardous fuels in forest stands. Mechanical reduction of under-story and mid-story fuels by mulching or chipping is an option for reducing stand density to allow the reintroduction of prescribed fire into forest stands.

Mulching machines have long been used to maintain utility right-of-ways. You have probably seen mulching machines working along the interstate highways in Alabama in recent years. These machines, which employ a horizontal-shaft head with teeth or knives [see Photo 1], differ from traditional right-of-way machines that employ a vertical-shaft head with blades (similar

to a “bush hog”)[see Photo 2]. Mulching heads can be fitted to a variety of carriers including rubber-tired, tracked, and

skid-steer machines. The head can be directly or boom mounted to the carrier. Horizontal-shaft mulching heads can



*Photo 2: Vertical shaft machine.*

fully chip or mulch the entire bole, limbs, and vegetation to a uniform size and can incorporate the chips into the soil if desired [see *Photo 3* and *Photo 4*].

As the technology incorporated into these machines has evolved, so have their potential applications. Most of these applications are common forest management prescriptions. Reducing understory and midstory fuels by mulching is one application that has already been mentioned. Other management objectives can also be met by mulching machines. For example, pre-commercial thinning of overstocked naturally regenerated stands. A demonstration held in Auburn last October involved a third row removal (thinning-to-waste) in an eleven-year-old pine plantation. This is not the first option a land owner or manager wants to consider with a stand of this age and size (9-inch average dbh), but it may be a viable option in closely planted plantations in times of low market demand for pulpwood. This demonstration also showed the potential of these machines in larger material. With mulching machines now on the market rated at 500 horsepower, even 9+ inch hardwoods offer little resistance. In the wildland-urban interface fire and smoke are not feasible. Mulching machines can establish and maintain firebreaks in these areas. Other applications include modifying stands to meet wildlife management objectives,



*Photo 3: Horizontal shaft machine in operation.*

controlling southern pine beetle outbreaks, site preparation, and clearing overgrown agricultural land.

The Forest Operations Research Unit of the USDA Forest Service, located in Auburn, Alabama has evaluated various different makes and models of mulching machines over the last several years. Productivity and cost studies were performed while the machines worked in several of the applications listed above. Machine productivity is affected by

spacing of residuals, operating pattern, prescription, terrain, operator experience and motivation, and machine type.

Productivity ranged from 0.2 acre per hour up to 1.6 acre per hour. Machine cost was calculated using the machine rate method. A cost per acre was calculated using the operating and owning cost calculated (including 30% for overhead and profit) and the measured productivity. A cost per acre for a typical midsize machine (200 horsepower) with productivity of 1.0 acre per hour was calculated to be \$180 per acre. This cost assumes the machine is performing an understory/midstory fuel reduction. A fifth row removal could conceivably be done for \$36 per acre.

In conclusion, mulching machines offer a variety of options to forest landowners and managers in meeting their management objectives. Potential applications include pre-commercial thinning, establishing firebreaks and wildlife plots, and controlling southern pine beetle outbreaks. Prescription costs for these machines are relatively high and a quote might easily double the figures presented in the previous paragraph. The short duration of most jobs, lack of experience with these kinds of treatments, and opportunity costs are all factors that affect prescription costs. As demand for these services increases, so should the number of contractors available to perform the work. ☛



*Photo 4: Mulched strip.*